THE SUSTAINABLE AVIATION FUEL OPPORTUNITY FOR NEW ZEALAND

Contact details

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Background:

Introduction to the New Zealand Biojet Consortium (the Consortium)

In 2016, Air New Zealand and Z Energy began working together to investigate the supply of 'biojet' for domestic flights. The group of interested parties quickly expanded to include Refining NZ, Scion and for a period, Auckland Airport.

The current consortium companies are Air New Zealand, Refining NZ, Scion and Z Energy, who are the authors of this submission.

The motivations of each company as a member of the Consortium are listed below:

Air New Zealand

Climate change is without doubt the biggest risk the airline industry has faced. As an airline we are already seeing the impact of climate change in New Zealand, with increasing volatile weather patterns and severe events such as cyclones and storms affecting flights and preventing customers from getting to where they need to go. The growth of the global aviation industry has created enormous economic and social good – it connects people and cultures, enables international trade and enterprise, and boosts tourism and local economies. While we are delivering such benefits and working in a variety of ways to reduce our carbon emissions, we are unlikely to deliver further significant carbon emission reductions in New Zealand without access to readily available aviation biofuels.

Refining NZ

As the manufacturer and supplier of ~70% of NZ's transport fuels we have a great opportunity to assist NZ through the transition to a low-carbon economy. We are excited by the possibility of playing a key part in the challenge to deliver tomorrow's fuels to NZ motorists and businesses. Our existing skills in operating and maintaining large industrial plant to manufacture transport fuels, and the key infrastructure assets that we own and operate in the transport fuels supply chain (deep water jetty, large tank farm, and pipeline to Auckland) provide the solid foundations to set up a large-scale bio-fuel manufacturing facility. This would benefit the local, regional, and national economy.

Scion

Scion is a Crown Research Institute with a statement of core purpose that includes bioenergy solutions for New Zealand. Scion has recently refreshed its strategy to 2030 to a focus on enabling New Zealand to transition to a circular bioeconomy. As such, this embodies using biomass to replace petroleum – i.e. replacing old carbon with new carbon and recycled carbon. A circular bioeconomy by its definition is a low carbon economy and requires design for holistic intergenerational solutions. Scion researches ways to create bioenergy (including technologies for biofuel production and utilisation) from woody biomass and waste. A focus on risk mitigation and benefits forms part of the assessment of technological opportunities for New Zealand, as evidenced in the Biofuel Roadmap for New Zealand. Scion sees progressing renewable fuels as a critical need for New Zealand and its international obligations.

Z Energy

Z is determined to reduce the carbon intensity of the products it sells. This has been a pillar of its sustainability stand since 2012, and the motivation behind building New Zealand's first commercial scale biofuels plant.

Prior to the formation of the consortium, Z, in partnership with pulp and paper manufacturer Norske Skog and the Ministry for Primary Industries (MPI), investigated how to generate more value from forestry waste by converting it to liquid biofuels as part of a project called Stump to Pump. The conclusion of the project at that point in time was that while it was technically feasible to convert the forestry residues to biofuel feedstocks suitable for the New Zealand market, the global economic and energy outlook made the commercial viability of Stump to Pump marginal and the technology was not yet sufficiently mature. Despite that finding, Z believes that incentivising the supply and demand of renewable fuels is a critical piece of the decarbonisation puzzle, particularly as it relates to the immediate opportunities or "low hanging fruit".

What is biojet?

Biojet, also called Sustainable Aviation Fuel (SAF), aviation biofuel or renewable jet, is a non-fossil fuel based renewable fuel suitable for use in aircraft in place of, or blended with, petroleum-based jet fuel. It can be made from a range of biomass feedstocks include vegetable oil, tallow, woody biomass and even municipal solid waste.

Unlike traditional, first generation biofuels, the chemical and physical characteristics of SAF are almost identical to those of conventional jet fuel, making it a “drop-in” fuel. This means that they can be safely mixed with conventional jet fuel, use the same supply infrastructure and do not require modifications to aircraft or engines.

While SAF by definition must be able to be drop-in replacements for conventional jet fuels, before they can be introduced into existing jet fuel supply chains, new fuels must demonstrate that they meet American Society for Testing and Materials (ASTM) specifications and gain ASTM certification following a rigorous programme of testing. Fuels must reach performance benchmarks that meet the operational and safety requirements of existing jet engines. These include properties such as energy content, freeze point, thermal stability, viscosity, combustion characteristics, lubricity, material compatibility, and other requirements specific to biojet. Certification of jet fuels is governed by ASTM 1655.

Previous activity

In 2017, the Consortium prepared the Business Case to explore the Pathway to viable and sustainable commercialisation of aviation biofuel in New Zealand. The intention was to apply for provincial growth funding for a full feasibility study. The business case concluded that while technically feasible, and presenting enormous potential for New Zealand, it would be economically unfeasible without a higher carbon price, high oil prices, policy support, government investment or a combination of some of these conditions. Given the absence of policy or economic signals at that point in time, the Consortium decided to pause this activity.

Please see Appendix B for a summary of the options that the Consortium considered for domestic biojet production.

Questions

Submissions on similar topics

Please indicate any other submissions you have made on relevant topics, noting the particular material or information you think we should be aware of.
Please find attached the Consortium’s business case based on the three most viable sustainable aviation fuel options for New Zealand (Appendix A). Some specifics have been withheld given this may become a publicly available document, but we are happy to share some of those details confidentially should it be of interest.

Commercially sensitive information

Do you have any objection to the release of any information contained in your response, including commercially sensitive information?

If yes, which part(s) do you consider should be withheld, together with the reason(s) for withholding this information.
No objection.

Questions for consideration:

Section A The first three emissions budgets

Under the proposed Zero Carbon Bill, the proposed Commission will have to provide advice to government on the levels of emissions budgets over the coming decades.

Currently, the Zero Carbon Bill requires budgets to be set from 2022-2035 (three separate budgets covering 2022-2025, 2026-2030, and 2031-2035). When preparing this advice the proposed Commission will have to consider the implications of those budgets for meeting the 2050 target. The Commission will also need to consider the likely economic effects (positive and negative) of its advice.

Question 1:

In your area of expertise or experience, what are the specific proven and emerging options to reduce emissions to 2035? What are the likely costs, benefits and wider impacts of these options? Please provide evidence and/or data to support your assessment.

This submission is focused on reducing aviation emissions, so the options presented in this response are specifically in relation to reducing aviation emissions to 2035.

A specific, proven (offshore) option to reduce emissions from aviation is the local manufacture of sustainable aviation fuel from domestic feedstock, which will have the co-benefit of creating jobs and stimulating regional economic growth.

2016 figures show that domestic aviation makes up approximately 6% of NZ GHG emissions from transport, with international emissions around 2.5 times higher.[1]

The airline industry is entering a period of increasing carbon regulation requiring greater aviation carbon reductions over time. For Air New Zealand the relevant regulations are:

Regulatory Systems	
UNFCC (Paris Agreement)	ICAO (CORSIA)
Domestic emissions (flights within NZ)	International emissions (flights between two countries)

[1] Ministry of Transport, Managing New Zealand's International and Domestic Aviation Emissions, p7: https://www.transport.govt.nz/assets/Uploads/Air/Documents/9e49e91886/Aviation-Emissions-Reduction-Plan.pdf

NZ ETS	Industry 2009 - 2020 Target	ICAO CORSIA	Industry 2050 Goal
AirNZ compliance obligations will increase from 83% to 100% of total domestic emissions by 2019	AirNZ is implementing fleet and operational changes to meet the industry's target of 1.5% average annual fuel efficiency improvements	Using 2020 baseline, from 2021, AirNZ will need to minimise and offset growth in emissions from international routes within CORSIA	NZ has also committed to the international aviation industry target of reducing net aviation CO_2 emissions to 50% of 2005 emissions by 2050

AirNZ has made real progress in reducing its carbon emissions through maintaining a modern fleet of fuel efficient aircraft fitted with new generation engines, fitting of fuel efficient "sharklets", implementing more fuel efficient departure climb profiles, improving approach path efficiencies, reducing aircraft weight and reducing auxiliary power unit operation. *However, without ready access to an approved SAF there are limited future carbon reduction opportunities available*.

AirNZ domestic flights (take off and land within New Zealand) produced a total 556,404 tonnes $CO_{2\text{-}e}$ for the FY19 year (greenhouse gas emissions are calculated using the MfE emissions factor for aviation fuel).

Based on ASTM certification allowing a blend mix of up to 50% SAF with fossil jet there is potential for Air New Zealand to displace up to 350mlpa of fossil fuel with ASTM approved SAF.

A 73% - 82% carbon abatement level for the SAF would provide a carbon reduction benefit of ~650,000 tonnes per annum for Air New Zealand alone.

The Consortium's Business Case in Appendix A presumes a minimum viable production amount of 100mlpa of locally produced SAF that displaces jet fuel. This amount would generate 200,000 tonnes of CO_2 abatement.

The appropriate technology for SAF already exists, and it is already at commercial production globally. To date, there have been 200,000+ commercial bio-jet flights completed globally. New SAF plants are coming on stream in Europe and the US, and Neste, already one of the world's largest suppliers of renewable fuel, is more than doubling the capacity of their Singapore plant, which will make them the largest provider of renewable fuel, including sustainable aviation fuel. It is worth noting that one of Neste's main feedstocks is New Zealand tallow, which they import into Singapore.

There is a unique opportunity for New Zealand to grow its own SAF industry, utilising local feedstock. The Scion Biofuels Roadmap clearly lays out the pathway to credible, large-scale biofuel production, including biojet[2].

The Consortium has taken this a step further by narrowing down the most promising technologies for New Zealand, conducting feedstock analysis, technical analysis and modelling on the most promising technology pathways for New Zealand, including an estimate of costs, GHG reduction impact, and economic impact.

Please see Appendix A for the full Business Case on the Pathway to Viable and Sustainable Commercialisation of Aviation Biofuels in New Zealand. Commercially sensitive and

[2] Scion, *New Zealand Biofuels Roadmap Summary Report*: https://www.scionresearch.com/__data/assets/pdf_file/0005/63293/Biofuels_summary_report.pdf

confidential information has been withheld however the Consortium are willing to disclose anything the ICCC believes to be relevant in assisting the Commission with its mandate to reduce GHG emissions.

Question 2:

In your areas of expertise or experience, what actions or interventions may be required by 2035 to prepare for meeting the 2050 target set out in the Bill? Please provide evidence and/or data to support your assessment.

International transport emissions are about 3.2 percent of overall global greenhouse emissions and are projected to grow as international trade and tourism expand.[3] As outlined above, there is currently an increasing need for airlines to reduce their GHG emissions, however aircraft fuel efficiency gains are plateauing[4] making sustainable aviation fuel the most realistic pathway to reducing aviation emissions to 2035.

The Consortium's modelling indicates that the economic returns for any investment in large-scale SAF production are poor in the short term, making it difficult to see any commercial investor volunteering the capital to invest in such a project without a step-change in some of the parameters assumed in the modelling e.g. carbon price, oil price, government funding, or a SAF consumption mandate. This is also seen in overseas markets, where commercial production of biofuels and SAF has only occurred when appropriate incentives have been put in place, for example in California with their Low Carbon Fuel Standard and in Europe, with the Renewable Energy Directive (RED).

Manufacturing SAF is more expensive than Jet fuel and comes with high start-up costs. Given the difficulty faced by private enterprise to justify investment when there is little policy certainty that SAF will be supported as a lower carbon option, *there is a need for government intervention to cause the necessary investment to happen*.

A combination of technology advancement and scale will likely bring costs down over time, but the ease with which aircraft can switch to SAF for immediate GHG emissions reduction makes fast-tracking the sustainable production of SAF worthwhile.

There are a number of ways to fast-track the production of SAF:

a. SAF mandate: New Zealand briefly had a biofuels sales obligation, albeit for road transport. A mandate would allow the higher cost of SAF to be spread across all litres of Jet fuel consumed, which would result in only a very minimal overall increase in fuel price. As an example, a 1% minimum bio-fuel volume uplift obligation would impose a 1.5% fuel cost increase (where bio-jet is 2.5 times the cost of Jet Fuel)

[3] file:///C:/Users/sheena.thomas/Downloads/GMBM-Cabinet-Paper.pdf
[4] https://www.greenaironline.com/news.php?viewStory=2130

b. SAF production incentive of NZ$0.75-1.60 p/litre (depending on the technology pathway).

c. Carbon price of over NZ$420 per tonne of CO_2-e, depending on the technology pathway. (A carbon price this high may have unintended consequences and we're not advocating for it as the right solution, but this ballpark is the commercial reality for biojet).

d. One-off capital grant of NZ$290m-$590m (depending on the technology pathway).

e. An enforceable GHG reduction programme for transport energy, such as California's Low Carbon Fuel Standard, which as of October 2018, has resulted in a reduction of over 38 million tons of carbon[5] from transport fuel emissions.

Any of the above measures would remove barriers for organisations or entities such as the Consortium, to actively pursue local SAF manufacturing. The lack of policy certainty is what caused the Consortium to pause committing to a full feasibility study to kickstart a SAF industry in New Zealand.

The demand side of the equation is already accounted for with Air New Zealand a part of the Consortium. This means that should a 100mlpa plant become operational in New Zealand, there will be a corresponding 200,000 tonne reduction in GHG emissions at the end of that year. Note that 100mlpa is notional. The facility will more likely target an output of 200mlpa to maximise economies of scale.

Question 3:

In your areas of expertise or experience, what potential is there for changes in consumer, individual or household behaviour to deliver emissions reductions to 2035? Please provide evidence and/or data to support your assessment.

Flying less is the most obvious way to reduce emissions, and the flight shaming movement, *"Flygskam"* has been gaining momentum globally.

However, tourism is a huge part of the New Zealand economy, second only to agriculture and sometimes surpassing the latter. A reduction in air travel will have a major impact on the New Zealand economy, not to mention the social and cultural impacts of being unable to visit family overseas, or travel.

Air New Zealand currently offers customers an easy way to offset their travel via *FlyNeutral*. This programme allows customers to contribute positively towards living in a more sustainable way. In FY2019 retail customers partially, or fully, offset 183,600 journeys which was up from 130,200 journeys in the previous year.

There is measurable growth in the number of retail customers and businesses choosing to contribute under the *FlyNeutral* program albeit in lower numbers than Air New Zealand would have hoped.

[5] https://www.forbes.com/sites/danielsperling/2018/10/17/how-almost-everyone-came-to-love-low-carbon-fuels-in-california/#716513165e84

Scandinavian Airlines (SAS), operates a creative mechanism for customers to support lowering aviation emissions. Since June 2019, SAS has been inviting their customers "to be part of the transition to a more sustainable way of traveling, with the possibility to purchase biofuel"[6] to help reduce carbon by 80% from the jet fuel it displaces.

Finnair has also introduced a service where its customers can either offset the CO2 emissions of their flights by supporting a CO2 emission reduction project or reduce emissions by buying SAF.[7][8]

Question 4: ***When advising on the first three emissions budgets and how to achieve the 2050 target, what do you think the proposed Commission should take into account when considering the balance between reducing greenhouse gas emissions and removing carbon dioxide from the atmosphere (including via forestry)?***
n/a

Question 5: ***What circumstances and/or reasons do you think would justify permitting the use of off hore mitigation for meeting each of the first three emissions budgets? And if so, how could the proposed Commission determine an appropriate limit on their use?***
n/a

Section B Emissions reduction policies and interventions

The proposed Commission will also need to consider the types of policies required to achieve the budgets it proposes. This consideration should include:

- sector-specific policies (for example in transport or industrial heat) to reduce emissions and increase removals, and
- the interactions between sectors and the capability of those sectors to adapt to the effects of climate change.

[6] https://www.flysas.com/en/sustainability/
[7] https://www.finnair.com/pushforchange

Question 6:

What sector-specific policies do you think the proposed Commission should consider to help meet the first emissions budgets from 2022-35? What evidence is there to suggest they would be effective?

See response to Question 2 above.

The clearest piece of evidence that renewable fuel mandates, emissions targets, production incentives and other government support such as capital grants can be effective, is the fact that countries that have these have more renewable fuel/transport energy as part of their transportation mix. Countries that are leaders in this area including Norway, Sweden and other countries in the EU, California in the US, and to an extent Japan. The consortium does not see the current ETS as providing sufficient narrative for change.

GHG emissions reduction from SAF, including biojet, has been clearly documented in studies around the world. Appendix A includes the Consortium view of the three most promising technologies currently, they range from a GHG reduction benefit or 73-82%.

While electric plans may be in use within a decade for domestic flights, there are no realistic options for longer haul flights in the short to medium term. Added to this is the high capital cost of replacing aircraft. The median age of an aircraft globally is 25 years, which means much of today's fleet will still be in use in 2035.

Yet the aviation industry needs to move towards climate neutral flying, and currently, SAF is the only viable way to do this.

Question 7:

What cross-sector policies do you think the proposed Commission should consider to help meet the first emissions budgets from 2022-35? What evidence is there to suggest they would be effective?

One policy to consider is to ring-fence the recently instated tourism levy for aviation carbon reduction activities.

Question 8:

What policies (sector-specific or cross-sector) do you think are needed now to prepare for meeting budgets beyond 2035? What evidence supports your answer?

See response to Question 7 above.

In addition, it is Refinery NZ's position that the Commission's work needs to identify businesses that have a track record of investing in new technology and ensure that policies do not undermine their 'absorptive' capacity. For example, arbitrarily reducing carbon unit allocation from energy intensive industries like refining could undermine their ability to contribute to emissions reduction targets – and in the case of Refinery NZ, to invest in making biofuels the future.

Section C Impacts of emissions budgets

The proposed Commission will need to consider the potential social, cultural, economic and environmental impacts of emission budgets on New Zealanders, including how any impacts may fall across regions and communities, and from generation to generation. Potential impacts may be either positive or negative.

Question 9:

What evidence do you think the proposed Commission should draw upon to assess the impacts of emissions budgets?

It will be important to draw on the global context.

The World Bank reported earlier this year on the lack of uniformity around carbon pricing schemes. Its June report, 'State and Trends of Carbon Pricing 2019'[9], noted that of the 185 parties that have submitted their Nationally Determined Contributions (NDC's) to the Paris Agreement, 96 - representing 55% of global GHG emissions - have stated that they are planning or considering the use of carbon pricing as a tool to meet their commitments. However, currently only 15% of annual global greenhouse gas emissions face a carbon price.

With this in mind, if our emissions budgets are too far ahead of the curve internationally, New Zealand's trade exposed industries like the refinery, could face a competitive disadvantage. That could lead to its closure and ultimately, to New Zealand being forced to import fuel product with a higher carbon footprint.

Furthermore, the Consortium notes that while budgets are important but on their own do not induce change. Positive investment in technologies and options will be needed alongside emissions budgets.

[9] http://documents.worldbank.org/curated/en/191801559846379845/State-and-Trends-of-Carbon-Pricing-2019

Question 10: ***What policies do you think the proposed Commission should consider to manage any impacts of meeting emissions budgets? Please provide evidence and/or data to support your assessment.***
Emissions budgets, particularly in relation to SAF, would need to be careful not to cause unintended consequences. For example, encouraging low emission fuels manufactured from unsustainable or unethically sourced feedstock would be counter-productive. An example is the use of unsustainably produced palm oil in the manufacture of biofuels. Lifecycle carbon intensity should always be taken into account, as well as ensuring that policies emphasise sustainable practices, particularly for feedstock. Domestic production as well as domestic use of feedstock should be favoured in policy given the emissions reductions from displacing imported fuel, or exporting feedstock, as well as the job growth and economic benefits it would create.

Section D Other considerations, evidence or experience

Question 11: ***Do you have any further evidence which you believe would support the future Commission's work on emissions budgets and emissions reduction policies and interventions?***
Proactive investment/support of feasibility studies, with the option for further capital investment or equity investment depending on the outcome of these studies. This would move New Zealand closer towards having its own SAF industry as there are organisations such as the Consortium that have the appetite and ability to co-invest.

Conclusion

Thank you for the opportunity to submit, and please let the Consortium know if there is anything you would like to discuss further.

The Consortium looks forward to policy settings that would enable audacious, GHG reducing and job-creating new industries in New Zealand.

Appendix A: Pathway to viable and sustainable commercialisation of aviation biofuels in New Zealand

Appendix B: Domestic biojet production infographic